Transformative Pedagogy:

From High Stake Testing to Culturally Responsive Mathematic Applications

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Abstract

Mathematics curriculums and pedagogy do not cater to minority students. This paper will concentrate on Latina/o students with the understanding of the battle of all minorities and the poor with insensitive curriculums and un-culturalized schooling. With the No Child Left Behind Act (NCLB) law, schools must perform according to standards and levels of achievement for fear of heavy sanctions and humiliating criticisms from the community and media. We must move away from extreme amounts of pressure we place on teachers and students starting at the third grade level all the way to high school graduation. Instead, we must reform the current accountability and test driven curriculum fad to a curriculum, in particular mathematics, which is culturally sensitive to students of all races, ethnicities, creeds, and gender. This paper will introduce the transformation from accountability to culturally responsive mathematics pedagogy. A brief literature review will set up the basis for a curriculum reformation. Reasons for transformative math pedagogy will be followed by a framework of intervention of engineering, place of the teacher, and ethnomathematics. Further discussions in the paper will allow for topics of further research and implications.

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Mathematics curriculums and pedagogy do not cater to minority students. This paper will concentrate on Latina/o students with the understanding of the battle of all minorities and the poor with insensitive curriculums and un-culturalized schooling. With the No Child Left Behind Act (NCLB) law, schools must perform according to standards and levels of achievement for fear of heavy sanctions and humiliating criticisms from the community and media. We must move away from extreme amounts of pressure we place on teachers and students starting at the third grade level all the way to high school graduation. Instead, we must reform the current accountability and test driven curriculum fad to a curriculum, in particular mathematics, which is culturally sensitive to students of all races, ethnicities, creeds, and gender. To begin the discussion, a background of the author will bring relevance to the topic followed by statistics of statewide assessments and a brief literature review. An analysis of the literature review will discuss gaps in the research which can be filled with frameworks of intervention of changing the place of teachers, teachers as engineers (Mourat Tchoshanov, personal communication, October, 2009), and ethnomathematics. These methods can transform from the current accountability trend to culturally mathematics pedagogy.

Background

In selecting a topic as my research my schooling as a Latino student, in a predominantly white conservative catholic German ancestry school based in a north Texas town of Nazareth, serves as my motivation to transform today's schools and curriculums, in particular mathematics

education, to better serve students who share my culture. My opportunities as an educator in the schools system for almost thirteen years also gives me the experience of understanding the territory on both sides of the fence. One side of the fence is my experience as a Latino student and the struggles with a school and a curriculum which did not explore nor understand my uniqueness of language, culture, and identity. Ogbu (1992) would say my situation is one of a voluntary minority, but my feelings are that of a involuntary minority. Instead, a culture of whiteness and a label of illiterate and need of special services (due to a second language at home even though English was the dominant language my parents spoke to me), were everyday hurdles in my schooling. My low capability of reading, writing, and speaking Spanish were ignored by the school as they continued to place me in pull-out programs to improve my spelling, grammar, and English vocabulary, which were already above average. This became a label incapable of removal with a stigmatism towards students of Latino decent like myself. High school also encapsulated white thinking and ideals in curriculum, particularly in mathematics education. Math textbooks were certainly white dominated with the absence of all cultures and their mathematical ideologies. Never once were cultures of Aztecs, Incas, Africans, or Asian and their contribution to the mathematics of the world ever taught.

The other side of the fence represents my experience as a mathematics educator in the middle school for over twelve years. My schooling and the experience in a subtractive culture (Valenzuela, 1999) continues to mold my mathematical pedagogy. Though my practice is far from perfect, my pedagogy and praxis search for new methodologies to encompass the uniqueness of cultures my students bring to class every day. As an educator in a predominantly Latino middle school population in West Texas, my experiences as a Latino student enables me to understand the needs of students who share my culture and to strive to understand students

from other minority cultures. Now we will analyze and interpret important statistical information on the high stakes accountability education of Latinos.

Data

According to the Texas Education Agency (2009a), 70.8 percent Latina/os complete high school compared to 88.8 percent of White students. For grades seven and eight, the dropout rates are 0.4 percent for Latina/os and 0.1 percent for White students. In grades nine through twelve, 4.4 percent of Latina/os dropout compared to 1.1 percent of white students. Hispanics do not believe in a system which devalues them. Schools become deficient in their ability to address needs of Latina/o students (Valencia, 1997) and the importance of culture.

With the implementation of the high stakes testing Texas Assessment of Knowledge and Skills (TAKS) tests, Latina/os achievement continues to lag behind their white student counterparts. 74 percent of Latina/os in seventh grade pass the TAKS Math portion compared to 87 percent of White students. 75 percent of Latina/os in eleventh grade pass the Texas Assessment of Knowledge and Skills (TAKS) Math portion compared to 89 percent of white students (TEA, 2009b).

Literature Review

High stake testing, with the passing of the NCLB as Ghani likes to say "No Behind Left on the Child" (Abdel Ghani Setra, personal communication, November, 2009) across the nation, is putting unprecedented strain on administrators, teachers, and students. Valencia (1997) states how high stakes testing produces obstacles for Latina/o success in schools. His deficit thinking ideology is based on how Latina/o students fail because of deficit thinking schools possess as they blame victims, use oppression, educability, and heterodoxy. Valenzuela (2005) states "…the

Texas system of educational accountability has failed- and will continue to fail- Latina/o and other minority youth and their communities" (p. 1). Valenzuela (2005) continues,

> The very notion of a mainstream, standardized education experience implies a system disregard of children's personal, cultural, and community –based identities. Rather than providing children with an empowering sense of how their lives can connect productively to the world that they inherit, a test-centric curriculum compelled by long arm of the state through standardized , high-stakes testing reduces children's worth to their test scores. (p.4)

What Valenzuela and Valencia are arguing is the mistake of trying a onetime massive assessment in order to understand the knowledge of students of differing cultures. These types of tests are incapable of truly assessing what a student knows or does not know much like textbooks are incapable of teaching everything students need (Apple, 2004). Students come with all types of background and student experiences (see Villegas & Lucas, 2002; Cushner, McClelland & Safford, 2003; Chiarelott, 2006; Hodgkinson, 2007; Darling-Hammond & Freidlander, 2008) which teachers ignore to value and understand in improving their own pedagogy and the education of Latina/o students. Hampton (2005) also states how schools become monotonous with test driven curriculums which ultimately sterilize students by narrowing their education. High stakes testing and NCLB pushes educators and schools to goals of test scores and positive ratings such as exceed expectations and recognized status rather than educating students in the interests of the public.

Analysis

This mathematics is certainly a drill and kill pedagogy which is irrelevant, unrealistic, and subtractive (Valenzuela, 1999). If schools and curriculums are to move away from accountability to a culturally responsive mathematics then research will need to exhume the practical applications of this type of pedagogy. Writing and talking about such pedagogy is merely theoretical. Teachers may or may not follow theory. They do demand; however, applications and methods to introduce in their classrooms. Educators do not want a theory; they want practical applications to use in critically responsive math pedagogy. Research is necessary to find these components and frameworks which can assist teachers. The literature review states the importance of such pedagogy, but nonetheless has gaps in stating and showing practical applications. Much like the Universal Design for Learning (UDL) theory (Meo, 2008) and actual practices (Daniel, 2007), and culturally responsive teaching (Villegas & Lucas, 2002), we need to establishes a theory of critical mathematic which allows students all the necessary components and methodologies to create critical consciousness and agency (Freire, 2000). Mathematics is the world's reasoning to the world's reasoning. We explain things mathematically in explaining systems and structures in our world. Mathematics is a tool in the interpretation of the world's gifts to humans and its mathematical beauty in nature. Math should empower. Math should question realities. Math should question structure and systems which recreate social class and the status quo. Math should marry up with social justice in indentifying statistics and math context which uphold hegemonic ideals from the dominant group. Math should question the actual math context students are learning now. Whose math are we learning? What purpose does mathematics serve? Who does it serve? How does it funnel me into a specific class? How does math recreate society? Which math would serve a better purpose for society at large? What is

math preparing me for? Is mathematics of today preparing me to enter the workforce of society, if so why?

Recommendations

Some recommendations for intervention and transforming the accountability mode of high stakes testing to a culturally responsive mathematics will encompass the three areas of pedagogy, curriculum, and culture. Reformation must occur to all three areas of curriculum, pedagogy, and culture in regards to improving Latina/o critical mathematics. All integrally connect to each other in their importance in creating a critically conscious student body of minorities in schools.

Practical applications in creating critical mathematics pedagogy must begin with the place of the teacher and the idea of engineering. First, how governments, districts, schools, administrators, and communities assign the place of educators needs examining. As Bowles and Gintis argue, schools reproduce society (Tim Cashman, personal communication, October, 2009; also see Anyon, 1980) which ultimately maintains the status quo. Place is the requirements and positions teachers have in the classroom. Place is the responsibilities of the teacher as being in charge of teaching and learning of students in mathematics. It is the "job title" many give to educators in the classroom. Currently, this place is one of passivity as a technician/assembler. The Texas Knowledge and Skills (TAKS) tells the educator exactly what mathematics is to be taught per grade level. The teacher takes the skills and teaches them in any order the districts' scope and sequence deems necessary. This is what a technician does. A company provides a technician pieces to produce a product, like an assembler. The technician/assembler may perhaps have a sequence in order to assemble the product. There is no gray area to improvise or the

product could have a defect. In the production process; however, there is one missing piece we are failing to acknowledge. This is the difference between a passive teacher and one of empowerment and transformation. The missing piece is the original framework and idea of the product. This product is a result of a teacher's idea, concept, choice (Glasser, 2007), and/or inquiry (Sparks & Louchs-Horsley, 2007). We will refer to this place as "engineering" (Mourat Tchoshanov, personal communication, October, 2009). The company (society) needs to fill a vacancy in creating a product (agent/student). The company then contacts an engineer (educator) and informs them of the aspects and details of the product (agent/student) they are wanting; in this case a critically conscious, transformative, agent/student (McLaren, 1994; Freire, 2000; Giroux, 2001; Grande, 2004; McLaren, 2007; Gay, 2007). First, the engineer (teacher) *analyzes* the needs of the company (society) and the product (student/agent) (see Jacobs, 2004; Posner & Rudnitsky, 2006; Hodgkinson, 2007; Meo, 2008;) and *creates* a framework plan (curriculum) (see Jacobs, 2004; Chiarelott, 2006; Posner & Rudnitsky, 2006; Brandt & Tyler, 2007; Glasser, 2007; Sparks & Loucks-Horsley, 2007; Meo, 2008). Second, after analysis, the engineer (teacher) begins creating a plan (curriculum)(see also Oakes, 1986; Pinar, Reynolds, Slattery & Taubman, 1995; Jacobs, 2004; Brandt & Tyler, 2007; Chiarelott, 2007; Meo, 2008; Purpel, 2009). Third, the engineer (teacher) then *implements* (teaches) the plan (curriculum). Fourth, the engineer (teacher) then *assesses* the plan (curriculum) (Chiarelott, 2006) and authentically assesses the product (agent/student)(see Cushner, McClelland & Safford, 2003; Chiarelott, 2006; Meo, 2008) to see if all steps are functioning properly and effectively. Finally, the engineer (teacher) may at this time, readjust (transforms) the plan (curriculum) or assessment to improve the product (agent/student) or production (pedagogy) process.

The context within the curriculum is essential in continuing to move away from accountability. Context is very important and should therefore be a tool for educators to implement and design (Chiarelott, 2007). Posner and Rudnitsky (2007) also show how to design a course curriculum by first analyzing your audience. They also state the importance how learning about your audience can provide insight into their diversity and their needs. This begins the process of how the teacher becomes an engineer of instruction. Designing is engineering. According to Gay (2007), education should teach reality and be sensitive to how different ethnic groups learn. Chiarelott (2007) states teachers can help design curriculums which relate content to real world situations. Teachers can assist connections by problem posing (Freire, 2000), self learning, peer learning, real situations, authentic assessments, active learning, appropriate context, construction of knowledge and service learning (Chiarelott, 2007). Math curriculums must question realities so student gain critical consciousness (Freire, 2000; McLaren, 2007) in structures within societies which oppress them. Curriculums should engage students in promoting inquiry, discovery, risk taking, rigor, and creativity (Greene, 2007; Sternberg & Lubart, 2007; Noddings, 2007; Darling-Hammond & Freidlander, 2008).

Curriculum must be sensitive to the diversity of students. Grande (2004) also argues in creating pedagogy that is emancipatory (McLaren, 1994; Freire, 2000). Takaki (1994) insists on telling the story of each ethnic group and their contribution to education and the nation. He also argues pre-service teachers to have the tools of multicultural education in order to serve minority students they will encounter in the future (Takaki, 1994). Meo (2008) introduces the UDL which accommodates all learners in setting goals, using methods, flexible materials, and assessments. Villegas and Lucas (2002) above all promote a culturally responsive teaching. They define culturally responsive teaching by having pre-service teachers use reflective writings,

simulation/games, family histories, sociocultural factors, personal histories and histories of diverse groups, service learning, school visits, and practica (Villegas & Lucas, 2002). In a mathematical context, all of these are applicable in any classroom.

A culturally mathematics education; for example, ethnomathematics, is one which values students' diversities. Mathematics already has stigmas of being difficult, boring, and irrelevant. In most classrooms, this is certainly true. We can learn from ethnomathematics and the mathematics of each of our student's cultures, backgrounds, and experiences (see Villegas & Lucas, 2002; Chiarelott, 2007; Cushner, McClelland & Safford, 2007; Darling-Hammond & Freidlander, 2007; Hodgkinson, 2007). D'Ambrosio (1997) states how ethno includes "all culturally identifiable groups with their jargons, codes, symbols, myths, and even specific ways of reasoning and inferring" (p.17). One form of ethnomathematics is street mathematics. Nunes, Schliemann and Carraher (1993) refer to street mathematics as the informal mathematics students learn from outside of school as an answer to the need of mathematical situations they encounter (see also Ascher, 1991; Powell & Frankenstein, 1997). Ethnomathematics can provide teachers and students a new perspective on learning mathematics from other cultures. Autoethnomathematics is how teachers and students discover and analyze their own street mathematics to uncover hidden treasures of knowledge and mathematical applications. Math curriculums can now change paradigms children have to one with a potential of creating constructive and critical mathematics to empower themselves in transforming society and opposing injustices of the world. Schools and teachers who implement such curriculums value and acknowledge students cultures and diversities. More research can assist in teachers achieving practical applications of culturally diverse mathematics.

Further research in mathematics can enable educators in searching for realistic applications in creating culturally responsive mathematics. Research in the areas of action research can also assist teachers who establish a culturally sensitive math environment. Their tools and techniques promote and acknowledge their student's cultures. Schools which promote culture and achieve high mathematical success can provide much needed applications and strategies. Characteristics of math pedagogy are essential in establishing which schools to research together with those who primarily serve minorities. States that adopt contemporary curriculums where minority student achievement is high in mathematics can also reveal applications of transformative pedagogy (Kitchen, DePree, Celedon-Pattichis, & Brinkerhoff, 2007). Schools districts which promote teachers to act as engineers show the effectiveness of such strategies. Globally, the U.S. can learn a great deal of teacher place in the classroom from countries in Europe, specifically in Russia (Mourat Tchoshanov, personal communication, October, 2009). Countries outside of the U.S. can also give valuable information on the applications and successes of ethnomathematics such as in Africa, Asia, Jamaica, West Indies, Mexico, Ireland, Finland, India, etc. U.S. border towns especially have unique opportunities to study street mathematics compared to school mathematics (Nunes, Schliemann & Carraher, 1993) along with the high mathematical achievement of immigrants. Comparing mathematic curriculums and pedagogy from differing countries will allow the U.S. to grow in providing holistic and relevant cultural educations.

Conclusion

In conclusion, a culturally responsive mathematics allows teachers flexibility and provides students with a relevant, empowering, and transformative education. High stakes testing is developing a stringent curriculum void of student identities, diversities, and cultures.

Movement away from such a paradigm is pertinent in order to provide a meaningful and relevant learning to Latina/os and other minority groups who continue to receive a disservice from educational institutions. With analysis of previous research, mathematical pedagogy can become culturally responsive in developing a framework which empowers students, values their educational background, cultures, and ethnicities with ethnomathematics and teacher as engineers. These methods will forever change the interest society possesses about education. Mathematics and research have the potential to change if schools provide opportunities to expand and support teachers and students in their endeavor to become transformative individuals. In this way, we all benefit from the education of young adults entering our society.

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